

# Improved Rhenium Thrust Chambers for In-Space Propulsion, Phase II

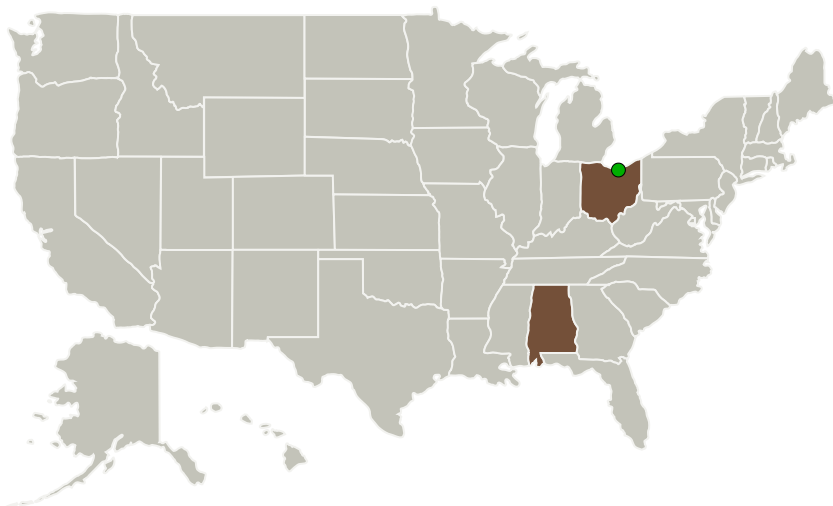
Completed Technology Project (2012 - 2018)



## Project Introduction

Radiation-cooled, bipropellant thrust chambers are being considered for the ascent/descent engines and reaction control systems for NASA missions such as Mars Sample Return and Orion MPCV. Currently, iridium-lined rhenium combustion chambers are the state-of-the-art for in-space engines. NASA's Advanced Materials Bipropellant Rocket (AMBR) engine, a 150-lbf iridium-rhenium chamber produced by Plasma Processes and Aerojet, recently set a hydrazine specific impulse record of 333.5 seconds. To withstand the high loads during terrestrial launch, rhenium chambers with improved mechanical properties are needed. Recent EL-Form™ results have shown considerable promise for improving the mechanical properties of rhenium by producing a multi-layered deposit comprised of a tailored microstructure, i.e., Engineered Re. During Phase I, an AMBR size chamber was produced to demonstrate formation of the Engineered Re material in both the throat and barrel regions. Tensile tests showed the Engineered Re material had a yield strength greater than 40ksi at room temperature. In addition, Engineered Re deposits were produced on multiple mandrels at one time, i.e., multi-component process demonstration. During Phase II, the Engineered Re processing techniques will be optimized. Detailed characterization and mechanical properties test will be performed. Optimization of the multi-component fabrication technique will result in a 30% or higher reduction in chamber fabrication costs. The most promising techniques will be selected and used to produce an Engineered Re AMBR size combustion chamber for testing at Aerojet.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

John Scott S O'dell

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Organizations Performing Work	Role	Type	Location
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Alabama	Ohio

## Images

## Briefing Chart Image

Improved Rhenium Thrust Chambers for In-Space Propulsion, Phase II  
 (<https://techport.nasa.gov/image/126488>)

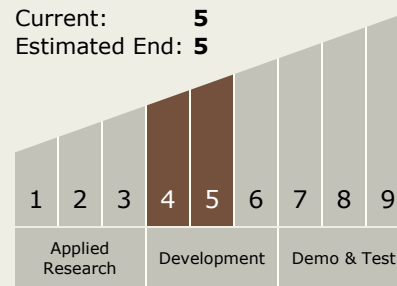
Project Management  
(cont.)

## Co-Investigator:

John Scott O'dell

Technology Maturity  
(TRL)

Start: 4  
 Current: 5  
 Estimated End: 5



## Technology Areas

## Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.1 Integrated Systems and Ancillary Technologies

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System